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DeVries

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(54) **CONVEYOR BELT CLEANER**

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(51) **Int. Cl.**[7] **B65G 45/00**
(52) **U.S. Cl.** **198/499**
(58) **Field of Search** 198/499

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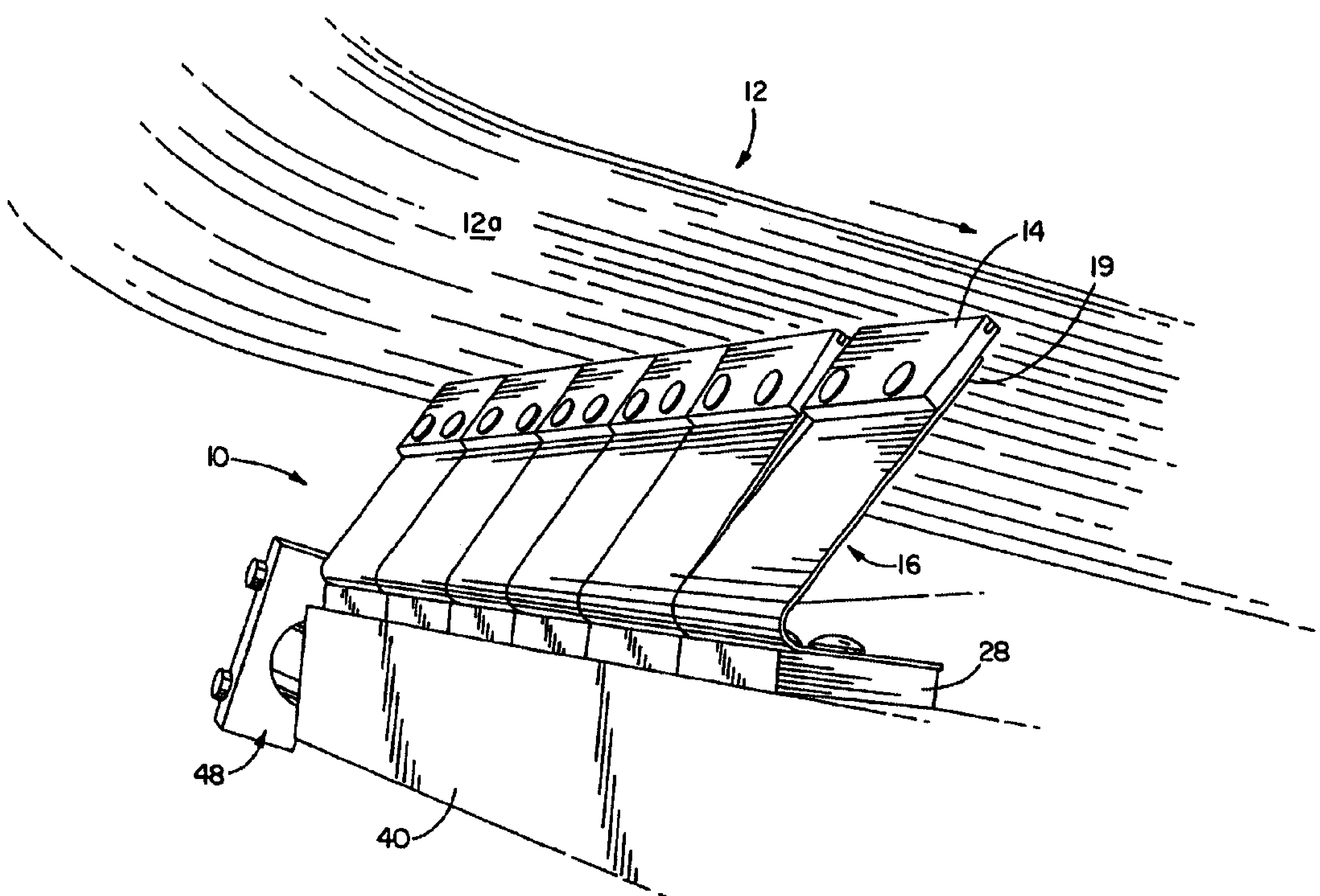
(57) **ABSTRACT**

A conveyor belt cleaner is provided that is particularly well-suited for high temperature applications. The cleaner includes a blade mount that has a layback arm mounting the cleaning blade and which can simultaneously deflect horizontally and vertically via changes in the radius of curvature of a lower arcuate portion connected thereto so as to minimize stress on the blade mount. The layback arm extends toward the conveyor belt at an acute layback angle relative to the immediately upstream belt surface. Preferably, the blade mount is of a shape retentive metal material so that it retains its bias force applied to cleaner blade even in high temperature and high loading conveyor belt applications. To keep the complexity of the blade mount to a minimum, it is preferably of a one-piece, angled spring plate construction including a base integral with the layback arm interconnected thereto by the arcuate portion.

19 Claims, 7 Drawing Sheets



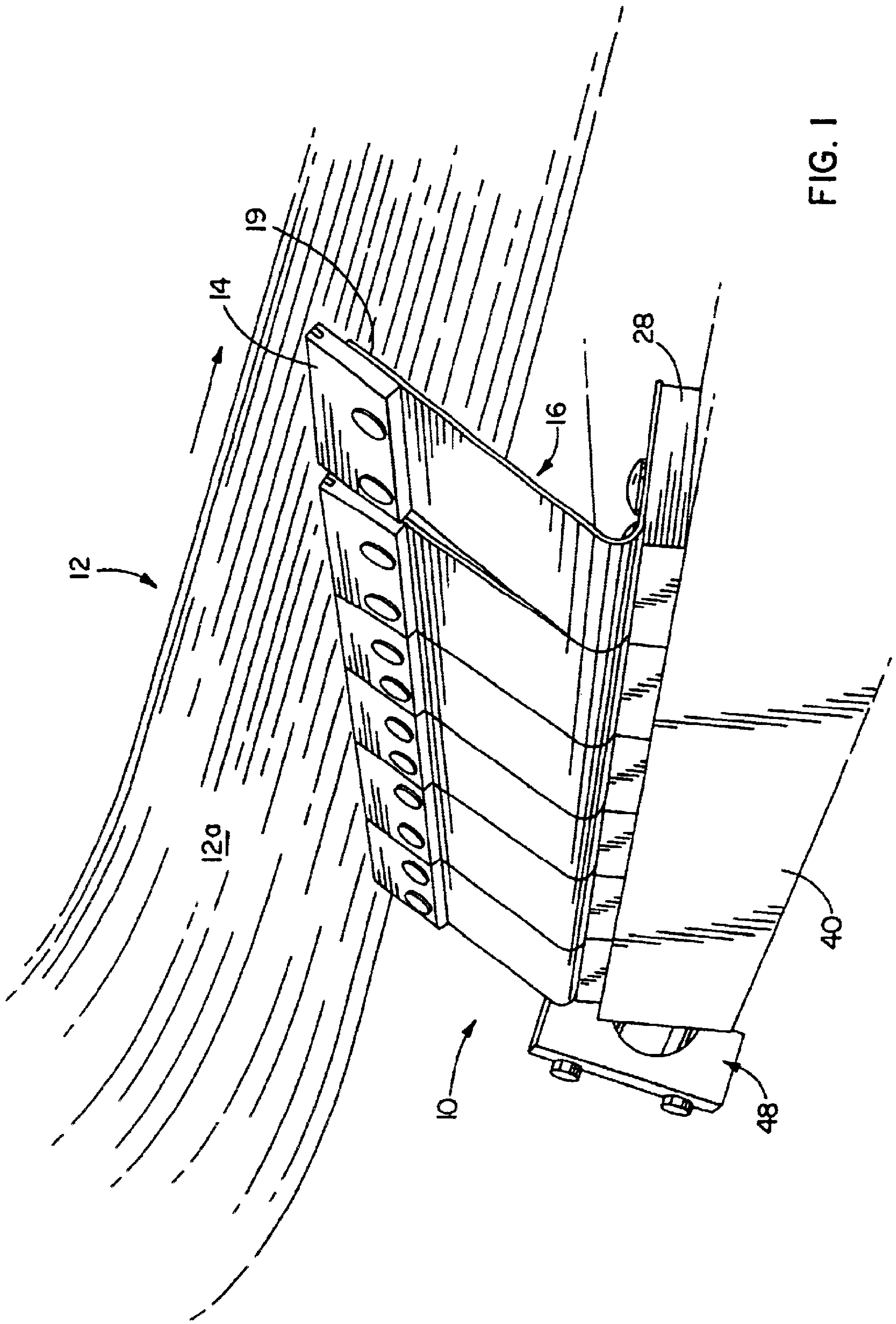


FIG. 1

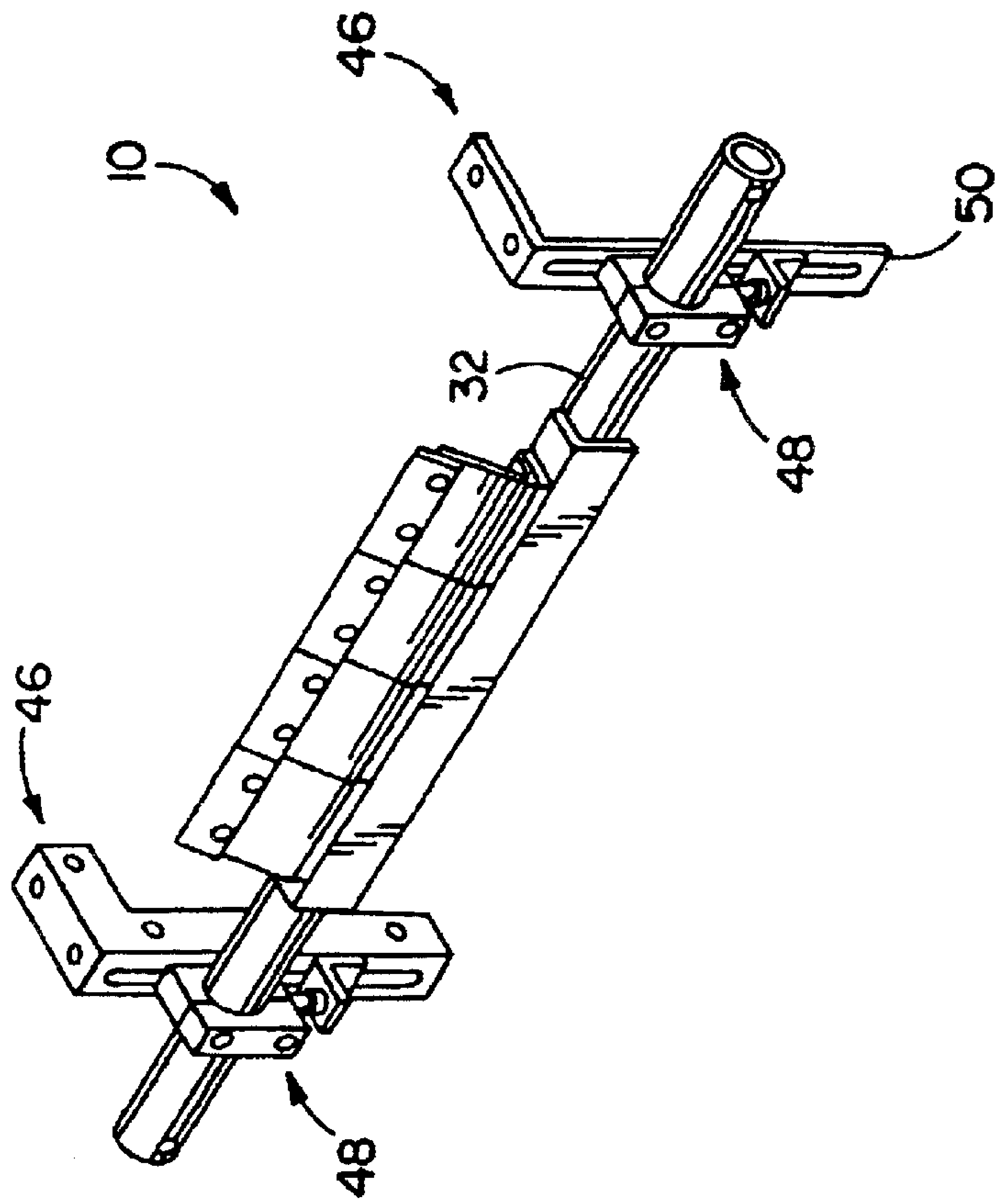


FIG. 2

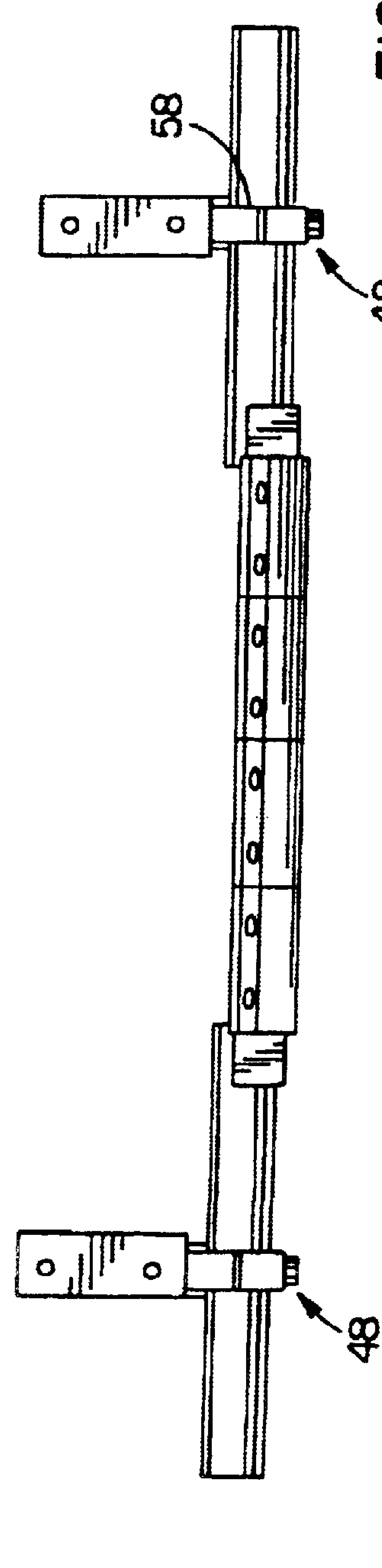


FIG. 3

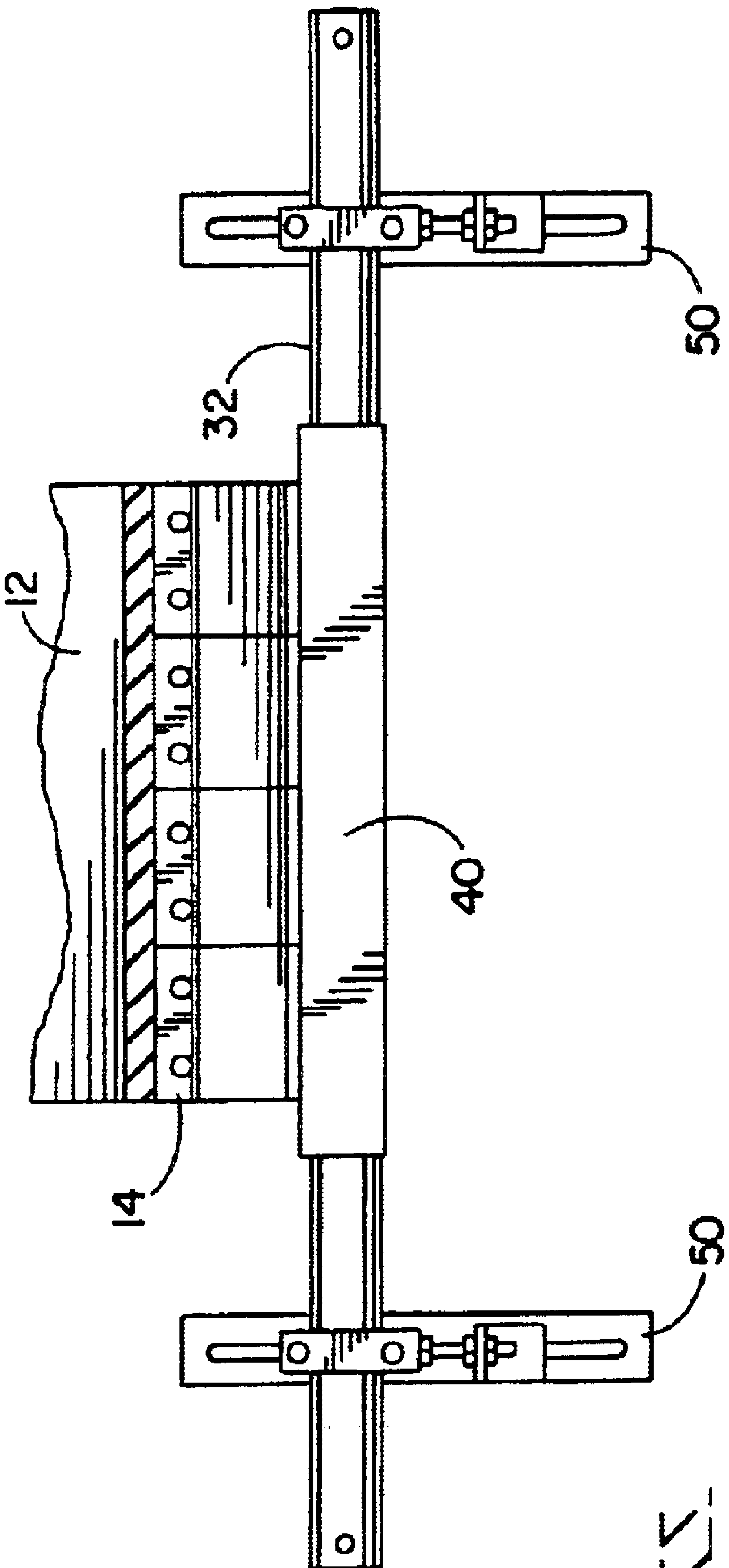


FIG. 4

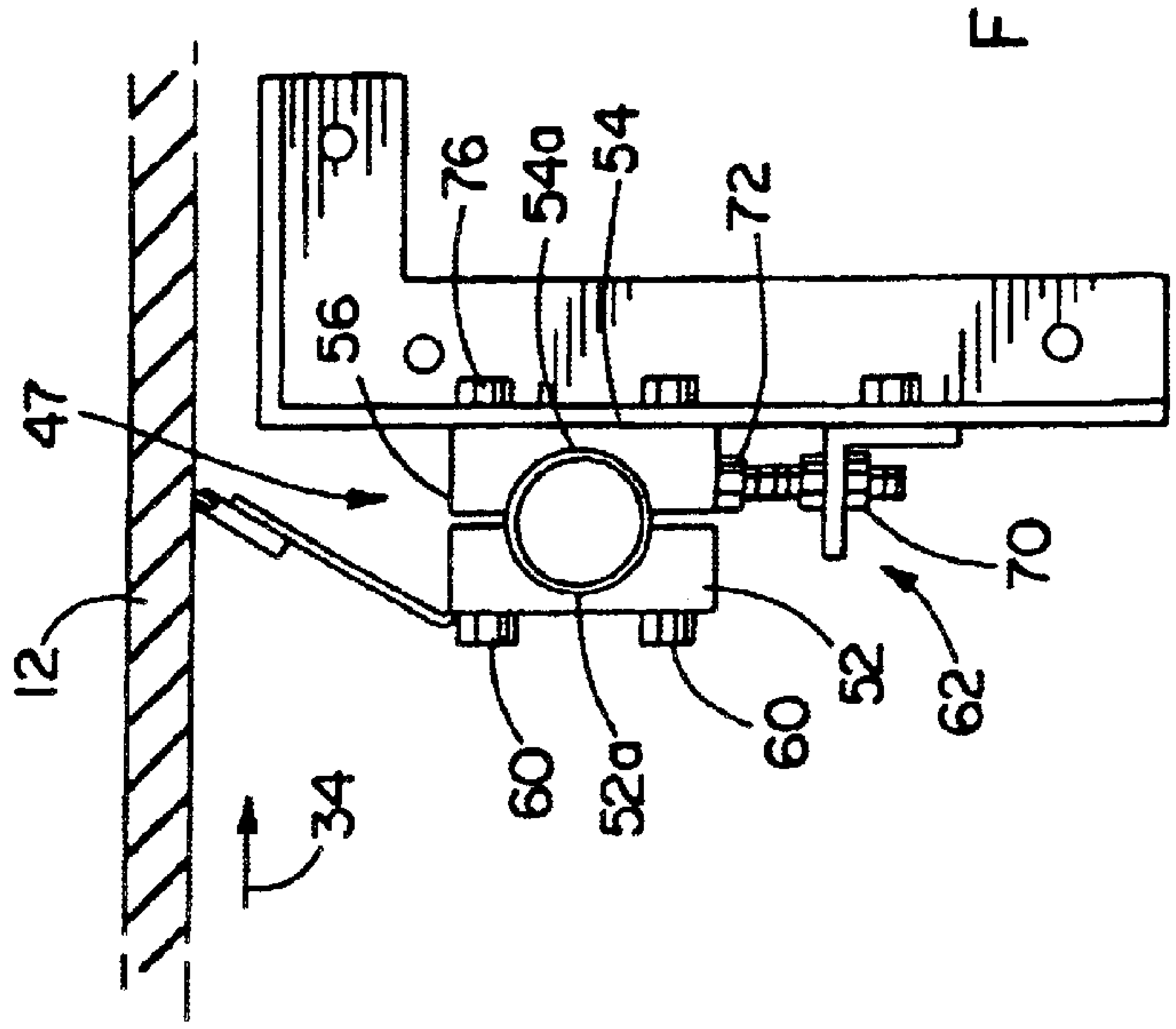


FIG. 5

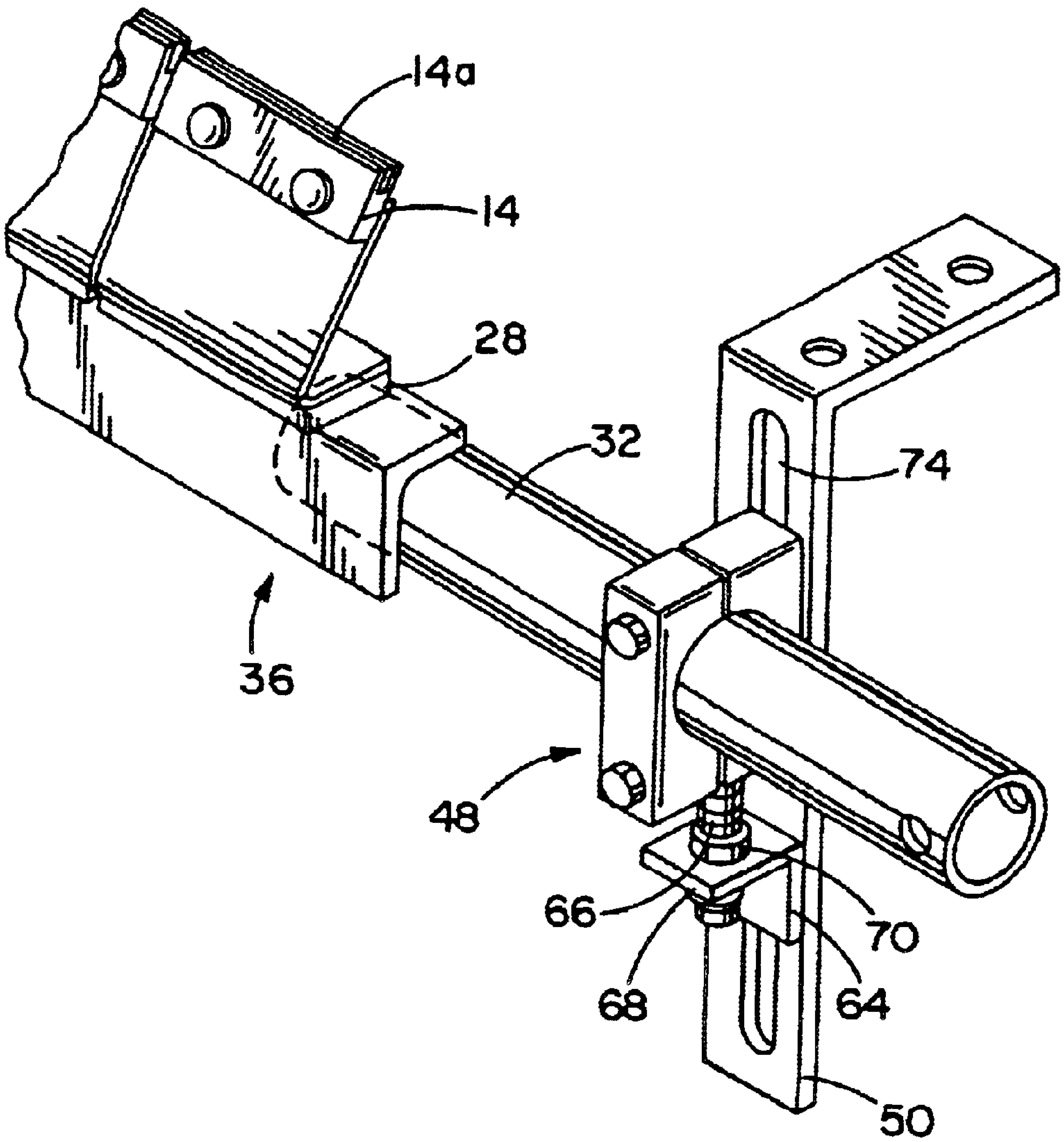
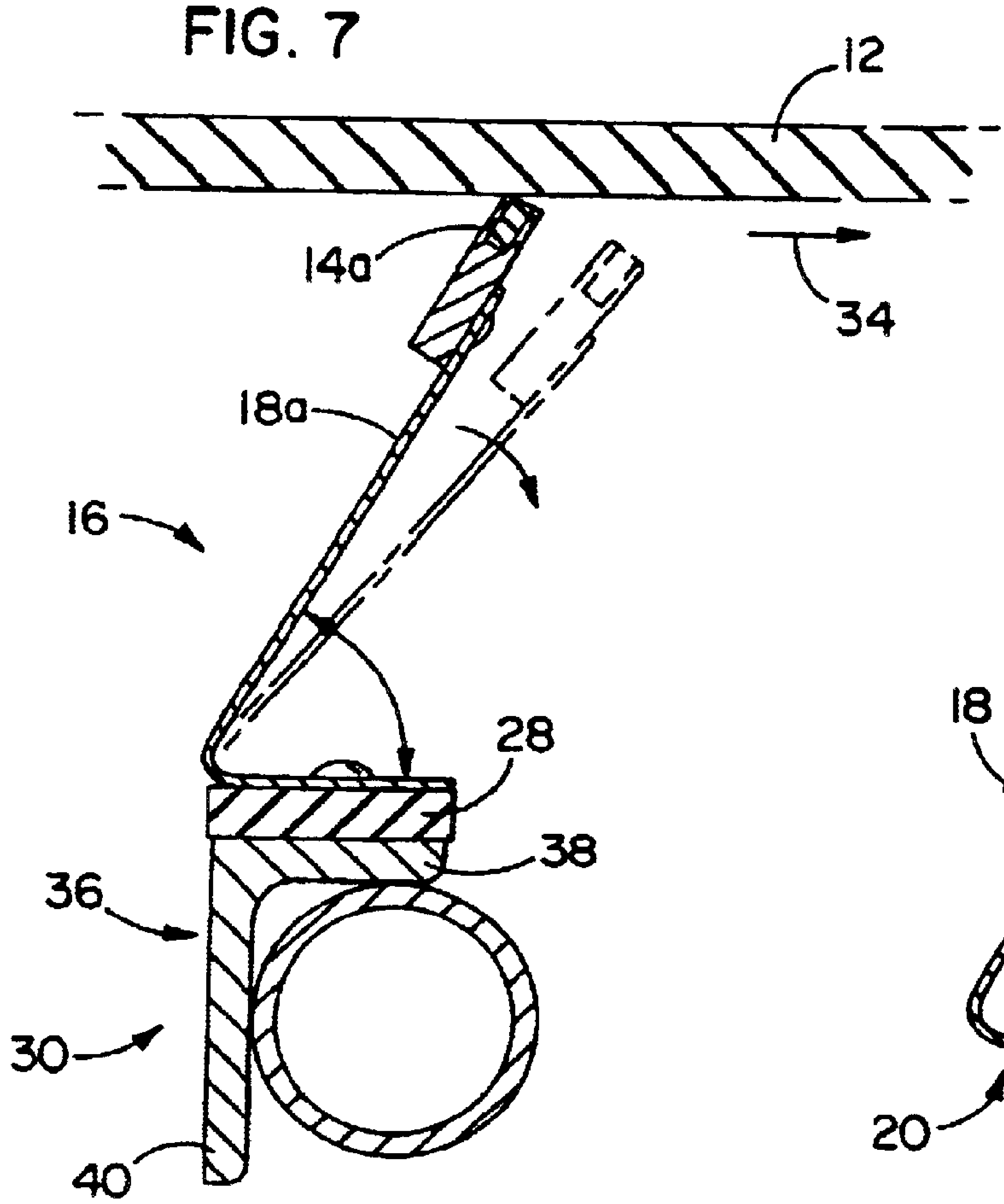


FIG. 6

FIG. 7



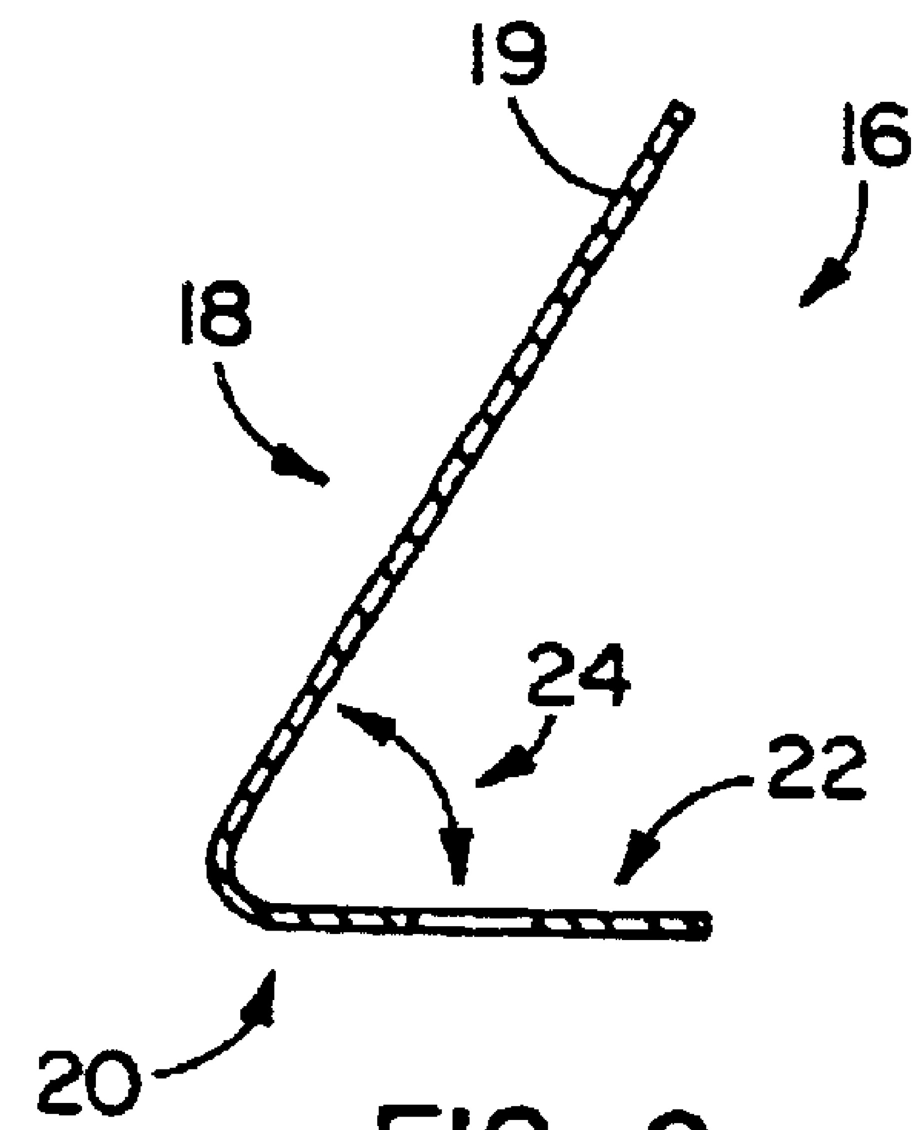


FIG. 9

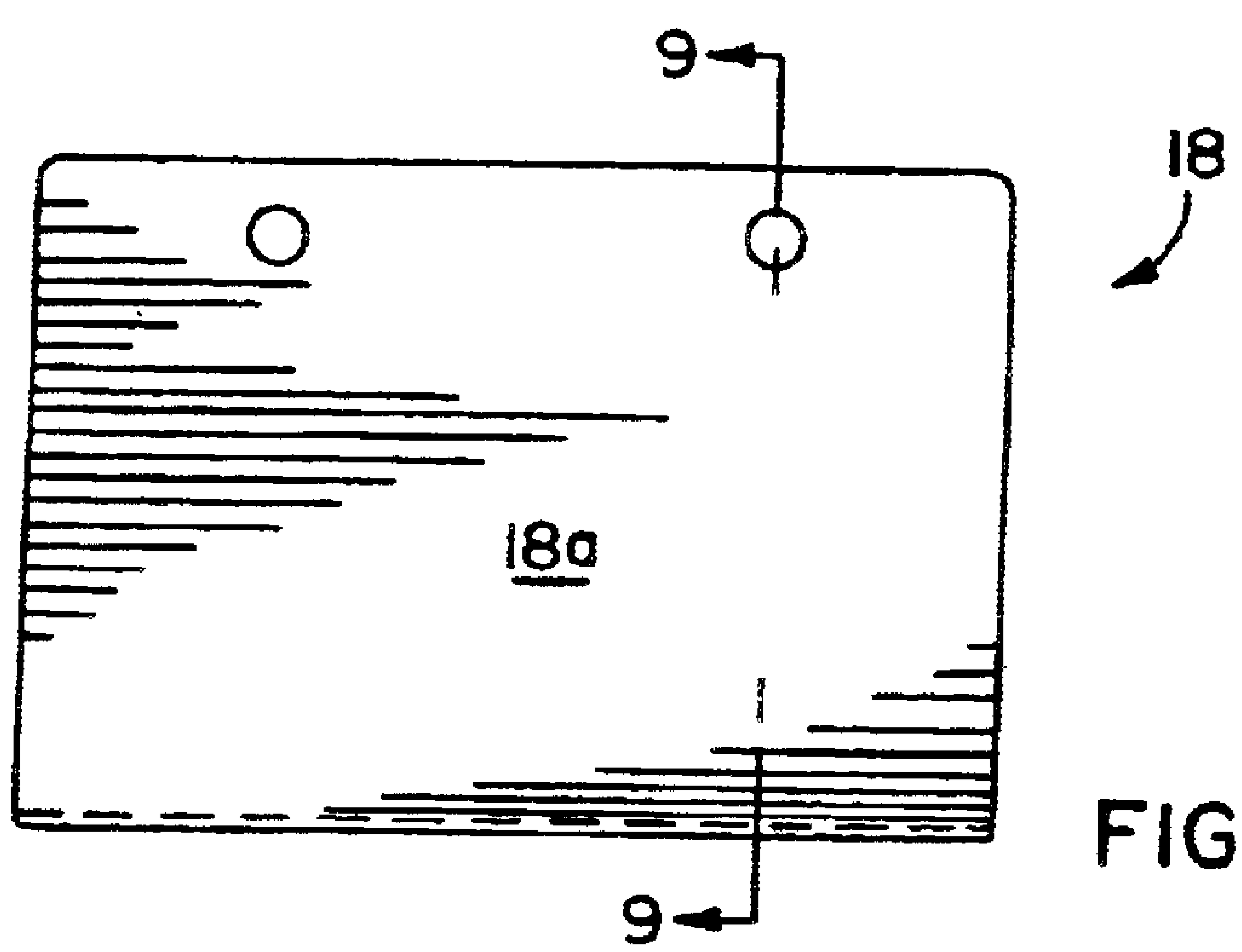


FIG. 8

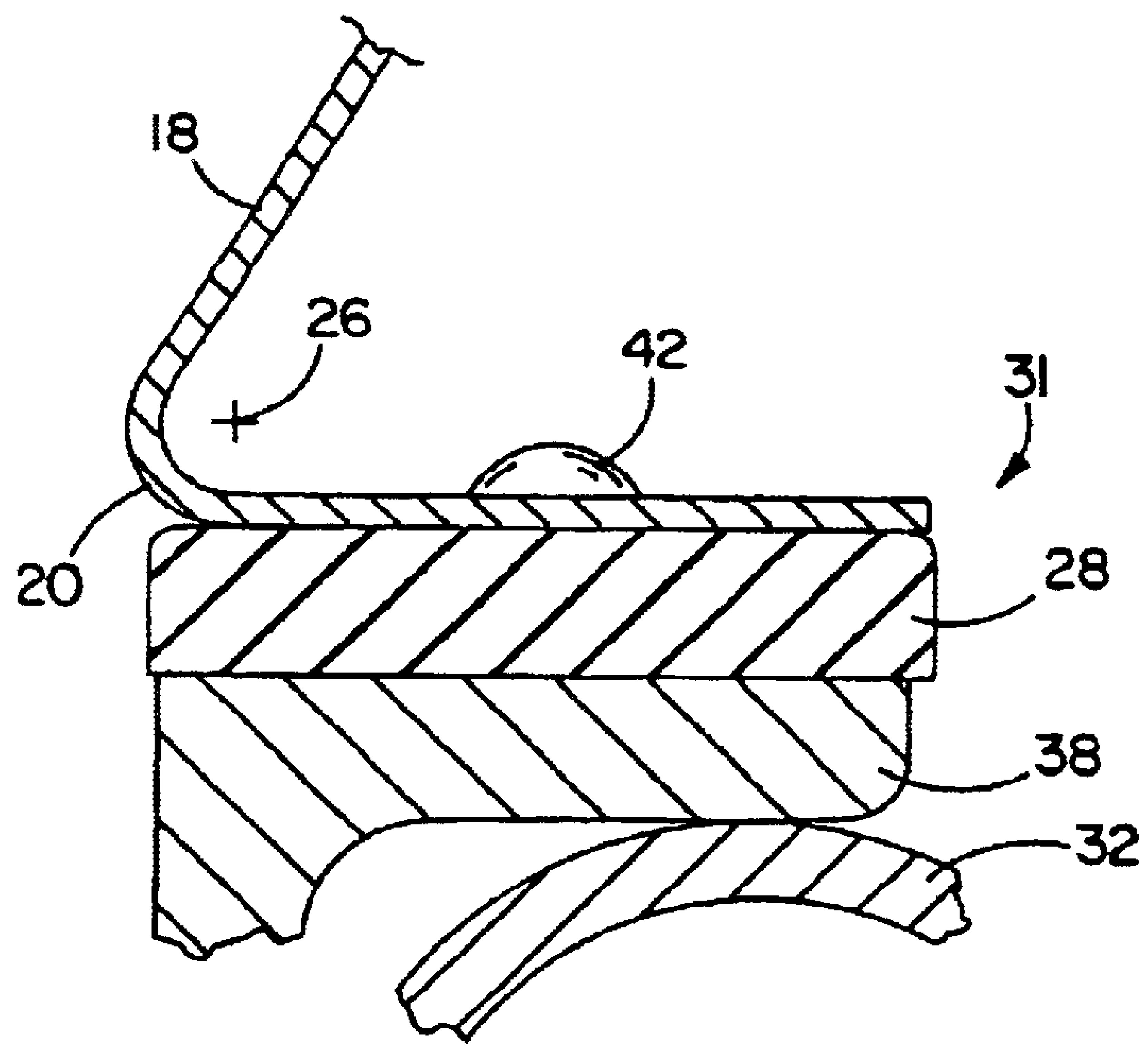


FIG. 7A

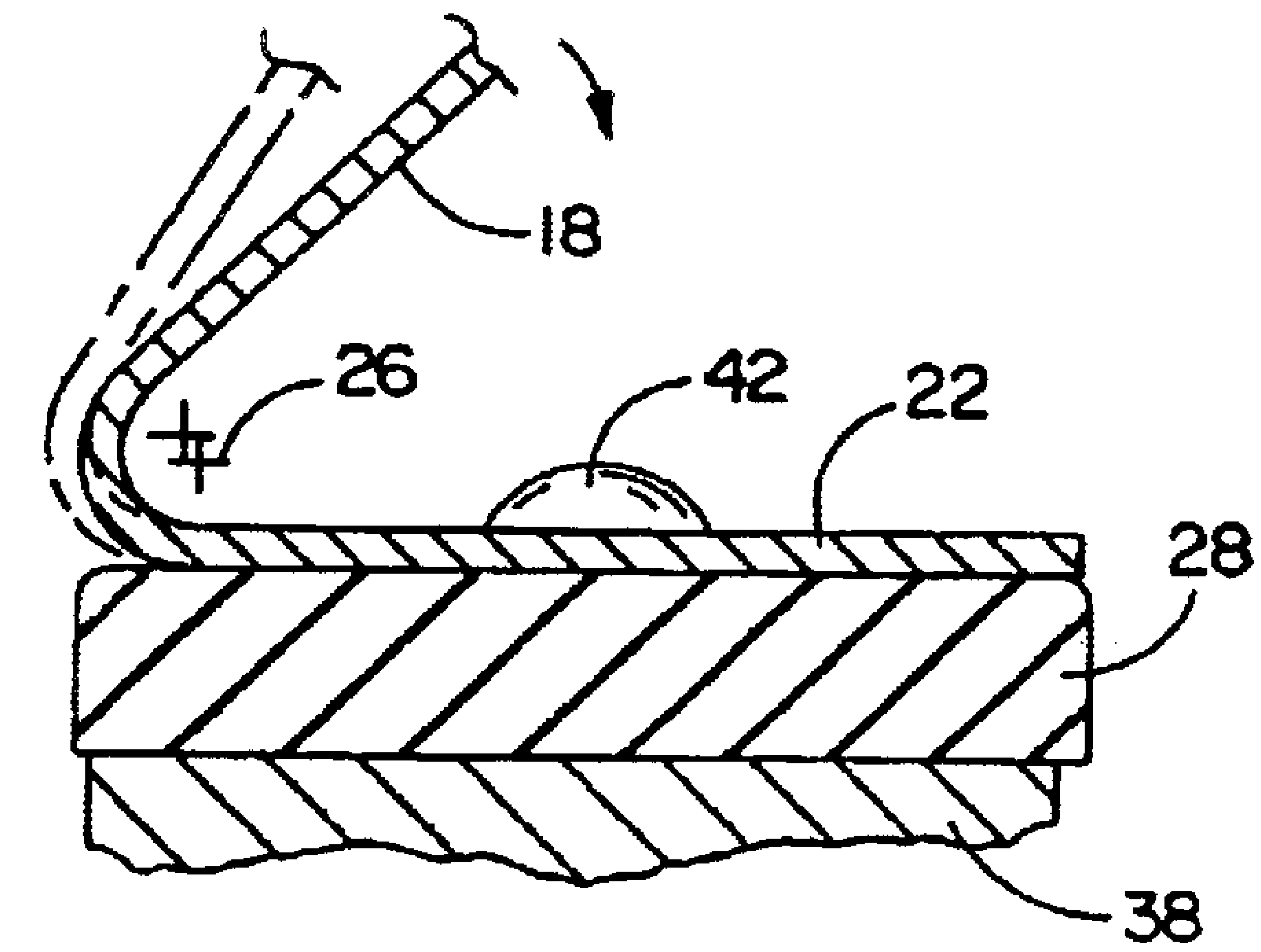


FIG. 7B

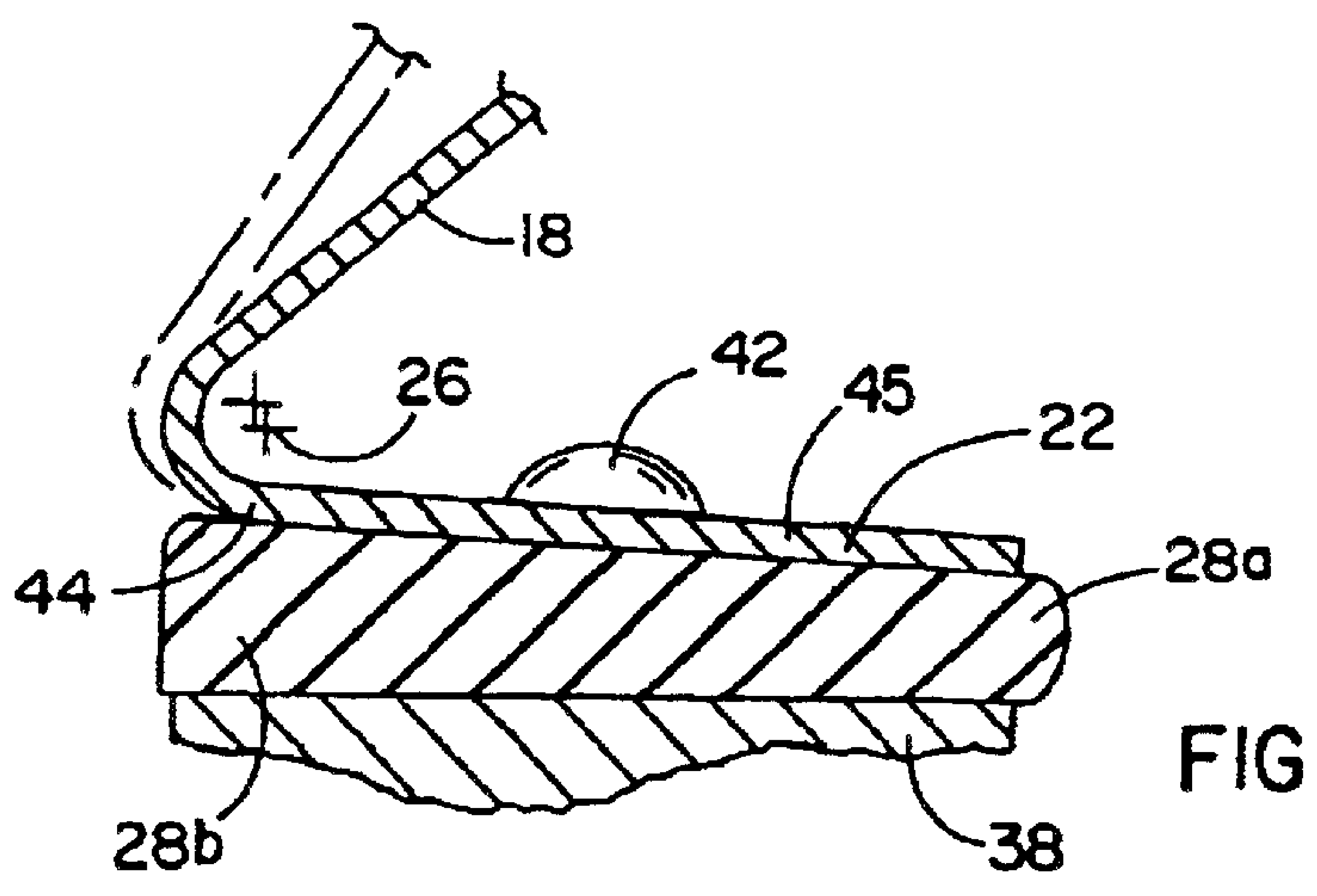


FIG. 7C

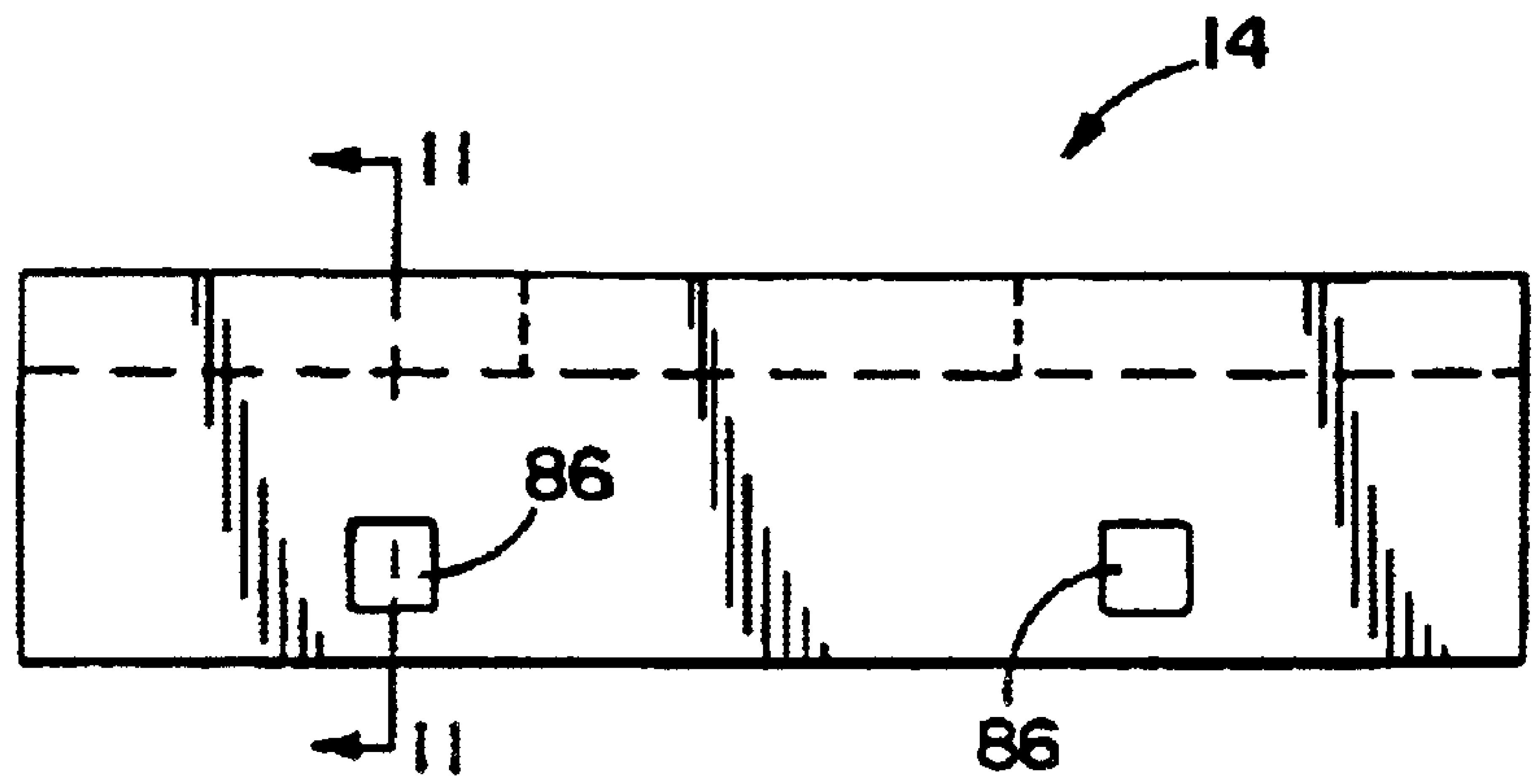


FIG. 10

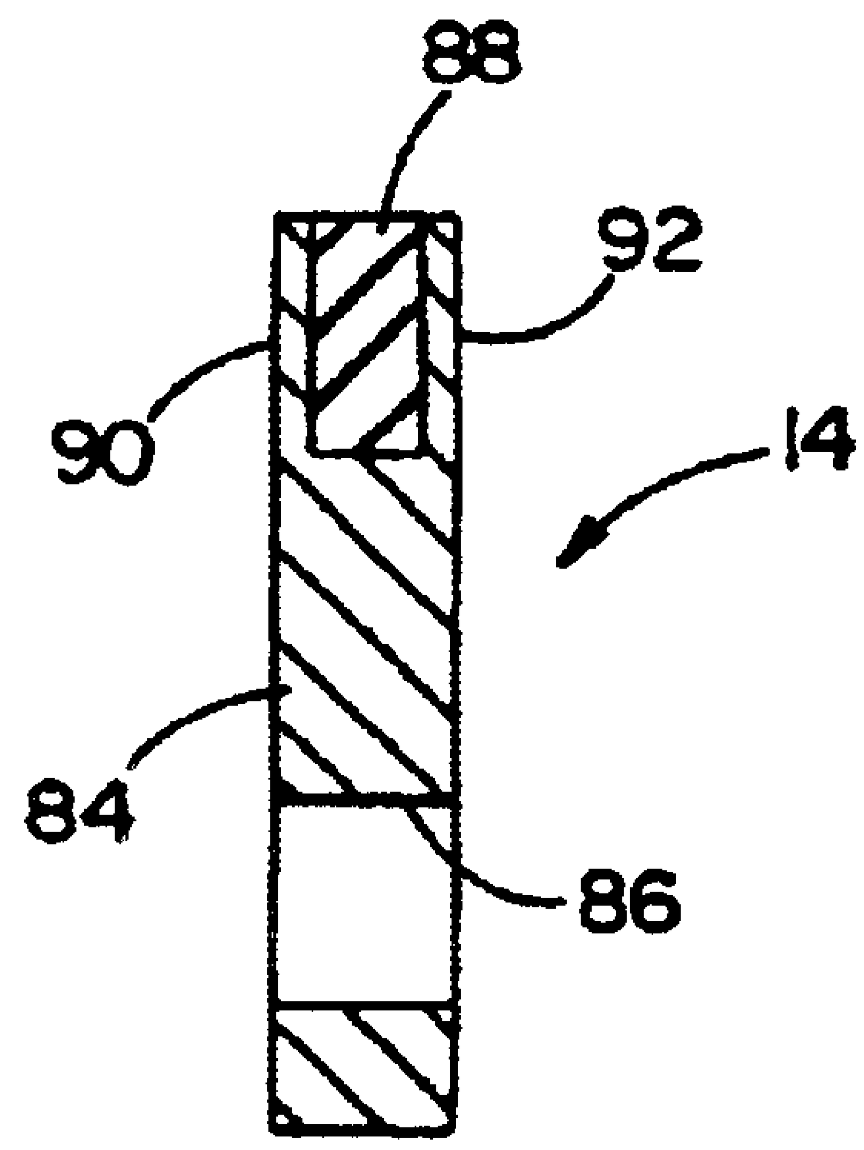


FIG. 11

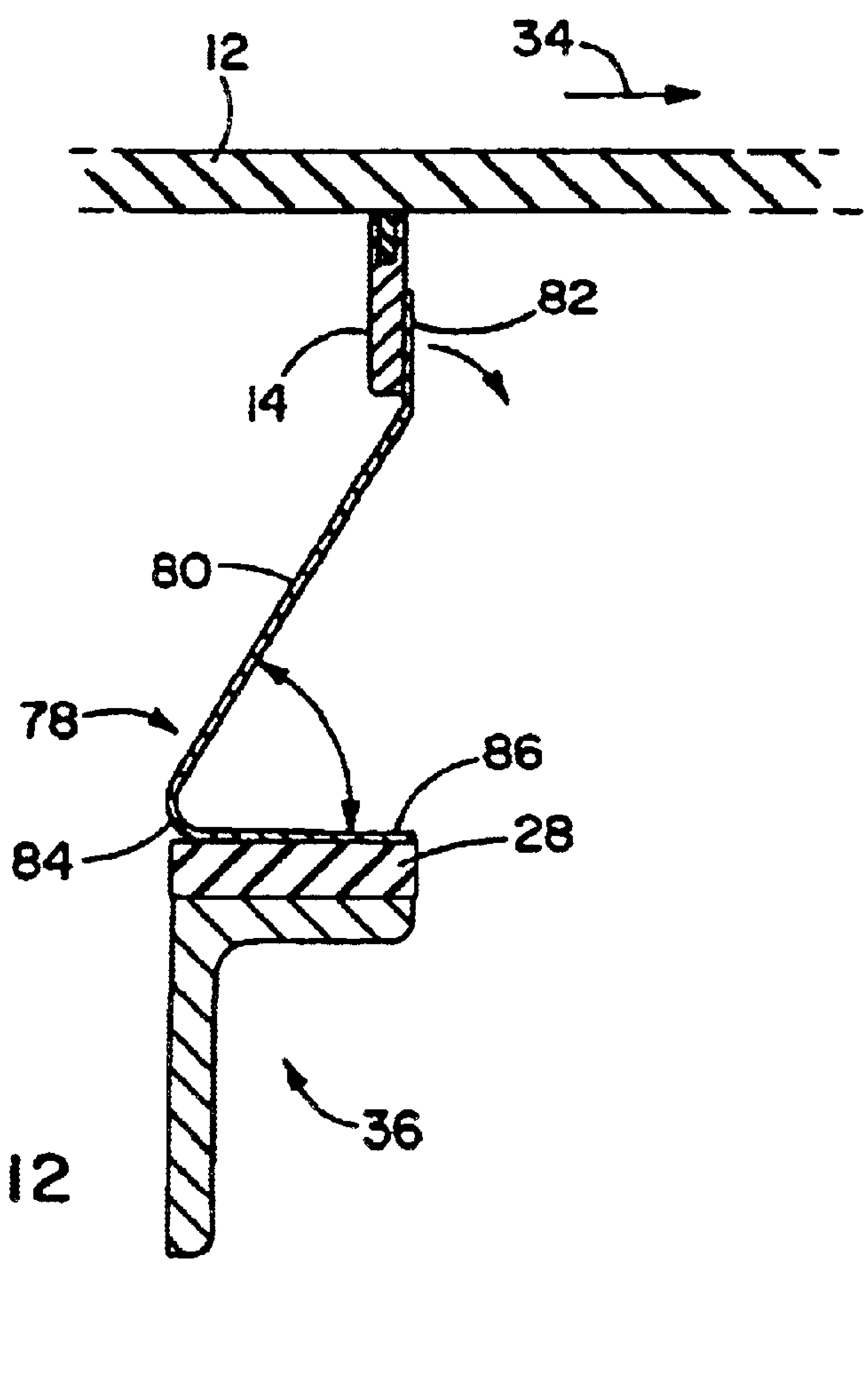


FIG. 12

CONVEYOR BELT CLEANER

FIELD OF THE INVENTION

The invention relates to cleaners for conveyor belts and, more particularly, to a mount for a cleaning blade for scraping a conveyor belt clean.

BACKGROUND OF THE INVENTION

Cleaners for conveyors that utilize a scraping element to remove debris and other materials from conveyor belts are well known. These conveyor belts often include metallic splices extending across the belt that run past the scraper blades during conveyor belt operations. The scraper blades are typically biased into engagement with the belt to allow them to resiliently shift away from the belt when surface irregularities on the belt are encountered such as due to the aforementioned metallic splices.

Generally, the goal of keeping the scraper blade in substantially constant contact with the belt to improve cleaning thereof is in competition with the need to allow the blades to shift away from the belt to avoid taking the full brunt of impacts with metallic splices and the like which can cause the scraper blades to rapidly wear. In heavier duty applications, this problem can be exacerbated by the use of thicker, more robust fasteners which create higher impact loads on the cleaning blade.

Another problem for keeping the blade in contact with the belt is its angle of attack relative to the belt. Generally, scalping angles where the blade leans forwardly or in the upstream direction as the belt travels downstream so as to form an obtuse angle with the belt surface upstream therefrom presents the most problems. With this aggressive angling of the blade, it will receive relatively high impact forces when encountering the splices or other carry-back materials on the belt. Also, these high impact forces can cause the blade to vibrate or "chatter" along the belt surface rather than staying in conformance with the belt reducing the cleaning efficiency of the blade. Catastrophic failure of the cleaner blade mounting components utilizing scalping angles is also of greater concern. Similarly, while a cleaning blade extending normal or vertically with respect to the belt surface to be cleaned is more desirable for cleaning, cleaning systems employing blade mounting members that only provide for vertical blade movements still can create high impact forces, particularly on belt splices which can cause excessive wear and ultimate failure of the splices.

By contrast, having the blade extending in the downstream direction so that it forms an acute angle with the belt surface upstream therefrom reduces the impact loading on the blade but can also create difficulties in keeping the blade in conformance with the belt surface. Unless the blade is heavily tensioned into engagement with the belt when the blade encounters even minor surface irregularities or variations in contour on the belt surface it will undesirably shift too far away from the belt. In other words, the sensitivity of the blade is not optimized in terms of its ability to stay in substantial contact with the belt surface when encountering relatively small irregularities in the surface of the belt that do not cause undue wear of the blade. Accordingly, when these irregularities are due to small pieces of material being carried back on the return run of the belt, the acutely angled blade may not be effective in scraping these off the belt surface. In such instances, it is better for the blade to stay tightly engaged with the belt for wiping the belt clean rather than to resiliently shift away therefrom. Another problem

with the acute angle of the blade is that any of the blade mounts extending at the same angle will have the material scraped from the conveyor belt surface falling thereon. If this material build-up increases, it can impair the ability of the scraper blade to effectively clean the belt surface.

For resiliently urging the scraper blades into engagement with the belts, the blade mounts can have pivot biasing mechanisms associated therewith. Generally, these biasing mechanisms have been characterized by their complexity in an effort to enhance cleaning efficiency while reducing blade wear. Particularly, the pivot biasing mechanisms typically employ several pivots and linkages between the conveyor frame and the blade, as well as separate springs such that there are several components which makes these systems more susceptible to wear and failure, see e.g. U.S. Pat. No. 3,952,863 to Schattauer.

Cleaning systems are also known that employ resilient bodies such as of polymeric or elastomeric material as the primary mechanism to resiliently hold the blade in tight engagement with the belt. These types of conveyor systems generally will not be effective in high temperature conditions where the material that is being conveyed and/or the surrounding environment can be at elevated temperatures, such as conveyor belts running at asphalt and cement facilities. In high temperatures, e.g. above 180° Fahrenheit, the polymeric or elastomeric materials can degrade so that the biasing force provided by these bodies dissipates rapidly over time. To this end, material creep for these materials can become a serious problem particularly in high temperature environments where creep can be accelerated. Likewise, the ability of polymeric or elastomeric creep materials undergoing accelerated creep to apply the same bias force to the blade over time will be compromised, as they may lose their ability to return to their original, relaxed configuration with excessive applied stress over long time durations.

Accordingly, there is a need for a conveyor belt cleaner that is better optimized in terms of its cleaning efficiency and the wear resistance of its cleaning blade. Further, a less complex mount for a cleaning blade is needed. A conveyor cleaner system that can be used in high temperature environments would also be desirable.

SUMMARY OF THE INVENTION

In accordance with the present invention, a cleaner for a conveyor belt is provided having a blade mount member for resiliently keeping a scraper blade in engagement against the belt. The blade mount member has a layback portion and a lower arcuate portion. The layback portion has the scraper blade secured to an upper end thereof and extends at a layback angle toward the belt with the lower arcuate portion spaced upstream of the upper end of the layback portion. The lower arcuate portion flexes during conveyor belt operations for controlled deflection of the layback portion that reduces loading thereon and substantially keeps the scraper blade engaged against the belt.

The use of a layback portion and a lower arcuate portion of the blade mount member presents several advantages for the present blade mount. In one aspect, the arcuate portion of the blade mount has a predetermined radius of curvature that decreases when flexed, which causes the layback portion to shift away from the conveyor belt. Thus, the displacement of the layback portion is not reflected in a corresponding amount of displacement of the flexible arcuate portion, reducing the stress in the blade mount. In other words, the flexible arcuate portion of the mount member avoids a static pivot point for the blade mount with the consequent highly localized stresses thereat, as instead, the radius of curvature of the arcuate portion changes and is reduced when the blade is loaded during its scraping engagement with the running conveyor belt. This effect is further enhanced by the relatively long length of the layback portion or arm of the blade mount member so that small decreases in the radius of the arcuate portion allow the blade to deflect sufficiently to reduce the force of high impact loads thereagainst.

Having the blade secured to the upper end of the layback portion or arm of the blade mount member allows it to more easily shift away from the belt, especially in the preferred form where the blade extends toward the belt with the same layback angle relative to the horizontal as the layback arm. As the blade is deflected, it simultaneously shifts both rearwardly or horizontally and downwardly or vertically due to the configuration of the blade mount member having the arcuate portion spaced upstream from the upper end of the layback portion and the blade thereat. For controlling this displacement of the blade, the radius of curvature of the arcuate portion is larger than the thickness of the arcuate and layback portions. Preferably, the radius is approximately two to six times the thickness of these blade mount portions. In this manner, the spring stiffness of the blade mount member is sufficiently robust to maintain good blade-to-belt contact with the sizing of the layback arm minimizing excessive wear on the blade, even in abusive applications.

More particularly, in use the layback arm portion is spring loaded with a predetermined bias force. When the blade is tensioned into engagement with the belt, the arm pivots back so that the layback angle will decrease from its size when the blade mount is relaxed. In one form, each degree of decrease of the layback angle increases the spring load of the layback arm by on average approximately eight pounds of force. For example, tensioning the blade into the belt can cause a decrease of approximately five degrees in the layback angle of the arm in its non-pivoted or relaxed configuration so that the arm and blade attached thereto are spring loaded with approximately forty pounds of force into engagement with the belt. Accordingly, as the blade undergoes normal wear, the spring load or bias force of the blade mount member keeps the blade biased into engagement with the belt surface as the layback angle can still increase back toward the relaxed layback angle of the mount while still maintaining a bias force on the blade to keep it in conformance with the belt surface.

In accordance with another form of the invention, a conveyor belt cleaning assembly is provided which includes a resilient blade mount. The blade mount preferably is of a shape-retentive metal material and secured to a rigid support of a frame for the conveyor belt. The blade mount is configured for resiliently biasing the scraper blade into engagement with the conveyor belt running in high temperature environments. As such, the cleaning assembly includes a blade mount with a minimal number of components and avoids the use of resilient bodies such as of polymeric or elastomeric materials that serve as the primary biasing mechanism for urging the scraper blade into engagement with the belts. In this manner, the cleaning assembly is well-adapted for use in harsh applications, and particularly where high temperature conditions are prevalent. In high temperatures, the metal blade mount herein retains its ability to return to its original, relaxed configuration prior to that taken when biasing the blade into engagement with the belt despite exposure to high stresses over long time durations. To this end, in contrast to polymeric/elastomeric material the present metal blade mount does not experience material creep or stress relaxation problems that can adversely affect its ability to be shape-retentive. In other words, even with the blade biased or tensioned into the belt such that the blade mount is loaded as by deflection of the layback arm, the metal material of the mount will keep substantially the same bias force on the blade despite the stresses to which it is subjected.

More specifically, the metal blade mount preferably is of a unitary, angled spring plate construction. In one form, the blade mount includes a layback portion that extends toward the conveyor belt and a base portion that extends at a layback angle to the layback portion. The layback angle is predetermined so as to minimize material build-up on the layback portion, e.g. in a range between approximately 30 degrees and up to approximately 85 degrees, and most preferably approximately 60 degrees. As mentioned, once the blade is tensioned into engagement with the belt, the layback angle will decrease with the deflected mount then providing the blade a resilient bias force that stays substantially constant during belt operations, albeit undergoing fluctuations due to deflection of the arm and consequent changing of the angle when the blade encounters surface irregularities on the belt.

Resilient material can be provided between the metal blade mount and the support for cushioning the blade during conveyor belt operations. The resilient material is preferably selected to be resistant to degradation at temperatures up to approximately 450° F.

In an alternative, the layback portion can include an upper or upturned end portion at the upper end thereof to which the scraper blade is secured. The upturned end portion extends normal to the conveyor belt for providing the scraper blade with an optimized angle of contact with the belt.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a conveyor belt cleaning assembly in accordance with the present invention showing a plurality of blade mounts each having a scraper blade attached to the upper end thereof that is biased into engagement with a conveyor belt.

FIG. **2** is a perspective view of the conveyor belt cleaning assembly of FIG. **1** showing a rigid pole support assembly fixed to opposite side conveyor framing members with the blade mounts secured to the pole assembly intermediate the conveyor framing members;

FIG. **3** is a plan view of the conveyor belt cleaning assembly of FIG. **2**;

FIG. **4** is a front elevational view of the cleaning assembly of FIG. **2**;

FIG. **5** is a side elevational view of the cleaning blade assembly showing a split block that provides for rotary adjustment of the pole assembly;

FIG. **6** is an enlarged perspective view of one of the side frame members showing a vertical adjustment slot for adjusting the tension of the blade in engagement with the belt;

FIG. **7** is a cross-sectional view of the blade mount including a resilient cushion attached thereunder and showing deflection of the layback portion about the lower arcuate portion as the belt is running;

FIGS. **7A–7C** are enlarged fragmentary cross-sectional views similar to FIG. **7** showing the changing radius of curvature of the arcuate portion as the blade is loaded;

FIG. **8** is a front elevational view of the blade mount member showing the layback portion thereof including apertures at the upper end for securing the cleaner blade tip thereto;

FIG. **9** is cross-sectional view taken along line **9**—**9** of FIG. **8** showing the angled spring plate construction thereof;

FIG. **10** is an elevational view of the cleaner blade to be attached to the blade mount member;

FIG. **11** is a cross-sectional view taken along line **11**—**11** of FIG. **10** showing a harden tip portion held at the upper end of the cleaner blade member;

FIG. **12** is a cross-sectional view of an alternative form of a blade mount member in accordance with the present invention showing the layback portion having an upturned end portion at the upper end thereof to which the cleaner blade is secured.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIG. **1**, a cleaning assembly **10** for a conveyor belt **12** in accordance with the present invention is illustrated. The cleaning assembly **10** includes a belt cleaner having a scraper blade **14** that is attached to a blade mount member **16** which resiliently keeps the blade in engagement with the belt **12** as it is running. The blade mount member **16** is characterized by its ability to keep the blade **14** in substantially constant contact with the surface **12***a* of the conveyor belt **12** despite surface irregularities, i.e. deviations from a smooth, flat surface, that may be present thereon, while still allowing the blade **14** to resiliently shift away from the belt **12** when necessary to avoid taking the full brunt of high-impacts due to such surface irregularities. In this manner, the blade mount **16** is well-adapted to provide optimal cleaning efficiencies for the present cleaning assembly **10**, and at the same time minimizes wear on the scraper blade **14** to increase the life thereof.

As can be seen best in FIG. **9**, the blade mount member **16** has a layback portion **18** and a lower arcuate portion **20** which flexes to allow deflections of the layback portion **18** which, in turn, shifts the blade **14** attached thereto to and from the belt **12** as it is running. The layback portion **18** extends obliquely relative to the horizontal and the conveyor belt surface **12***a* running thereabove. More particularly, the arcuate portion **20** is disposed upstream of the upper end **19** of the layback portion **18** such that the layback portion **18** extends upwardly toward the belt **12** from the arcuate portion **20** and rearwardly or downstream relative to the belt **12** to form an acute angle with the belt surface **12***a* upstream therefrom. Thus, when the blade **14** is impacted, it is simultaneously deflected back horizontally and vertically downwardly as the arcuate portion **20** flexes and the layback portion **18** leans further rearwardly.

In the preferred and illustrated form, the blade mount member **16** is of a unitary construction such that the layback portion **18** and arcuate portion **20** are part of a single piece of metal material having an angled spring plate construction. The material for the spring plate blade mount can be spring steel, such as a hardened **410** stainless steel material. The preferred unitary metal blade mount **16** that resiliently biases the blade into engagement with the belt **12** is of particular advantage in situations where the belt **12** is operated in high temperature conditions. In these harsh conditions, the spring steel blade mount **16** is able to retain the bias force for the blade **14**, as opposed to those blade mounting systems that rely on rubber or other resilient polymers to provide this force. The steel material will not experience material creep problems and thus will stay shape retentive despite exposure to high temperatures and high loading or stresses thereon so that any loss of bias force provided to the blade **14** by the mount **16** over long durations of conveyor belt operations will be kept to a minimum. It is manifest that other constructions employing the layback and arcuate portions **18** and **20** of the blade mount member **16** can be utilized such as by having these be separate components; however, the unitary or one-piece construction illustrated herein is preferred to reduce the complexity of the present blade mount **16**.

The blade mount member **16** preferably also includes a base portion **22** with the arcuate portion **20** interconnecting the layback portion **18** and base portion **22** at a predetermined angle **24** therebetween. As shown, the base portion **22** extends generally horizontally and rearwardly or downstream from the arcuate portion **20**, although such horizontal orientation is adjustable as described hereinafter. Thus, the angle **24** can substantially coincide with the layback angle at which the layback portion or arm **18** of the unitary angled spring plate member **16** extends toward the belt surface **12***a*. However, since the layback angle is referenced with respect to the horizontal, the angle **24** may vary slightly from the layback angle if the base **22** is adjusted to be slightly pitched from the horizontal although these angles will be referred to interchangeably herein.

The predetermined layback angle **24** is carefully selected in conjunction with the stiffness or resilience of the spring plate member **16** to keep the blade **14** in substantial conformance with the belt surface **12***a* despite loading thereof such as due to surface irregularities along the belt surface **12***a*. The layback angle **24** and stiffness of the spring plate member **16** in conjunction with the length of the arm **18** allow carefully controlled movement of the blade **14** away from the belt surface **12***a* as such loads become more excessive, such as due to projecting metal fasteners of any belt splices that may be encountered by the blade **14**. In this way, damage to the belt splices is substantially minimized.

Also, the layback angle **24** is such that the flat upwardly facing surface **18***a* of the layback arm **18** is not susceptible to excessive material accumulation thereon as scraped from the belt surface **12***a*, which can adversely affect the cleaning efficiency of the blade **14**. By way of example, the layback angle **24** can be approximately 60 degrees which is akin to that of some chutes that feed material onto conveyor belts. In this manner, when the scrapped material from the belt surface **12***a* falls onto the flat surface **18***a* of the blade mount layback arm **18**, it will slide off therefrom rather than accumulate and build-up thereon. In addition to the illustrated 60 degree angle, layback angles **24** that are in the range of approximately 30 degrees to approximately 85 degrees are also contemplated herein.

Accordingly, the configuration and sizing of the layback and arcuate portions **18** and **20** of the blade mount member **16** provide improved conformance of the cleaner blade **14** with the belt surface **12***a* while allowing the layback portion **18** to resiliently deflect as necessary when encountering excessive applied loading to the blade **14** as the belt **12** is running. In other words, the layback and arcuate portions **18** and **20** of the present blade mount member **16** provide it with a robust configuration without creating undue wear at the blade **14**. Also, as the blade **14** undergoes normal wear at the upper scraping tip **14***a* thereof, the force applied by the blade mount **16** is able to keep the blade tip **14***a* in close conforming contact with the belt surface **12***a*, as described more fully hereinafter.

Referring to FIGS. **7A–7C**, it can be seen that the radius of curvature of the arcuate portion **20** as denoted by point **26** changes as the blade **14** is loaded. Comparing the radius at point **26** in FIG. **7A** where the belt **12** is not running and the blade **14** has yet to be tensioned into engagement with the belt **12** to the radius at points **26** in FIGS. 7B and 7C where the blade **14** is tensioned into the belt **12** and the belt **12** is running, it can be seen that the radius of curvature decreases as the blade **14** is loaded and the layback portion **18** shifts toward the base portion **22** decreasing the angle **24** therebetween. The radius of the arcuate portion **20** is significantly smaller than the length of the layback arm **18** so that relatively small flexing movements of the arcuate portion **20** generate significantly larger displacements of the blade **14** at the upper end of the relatively long arm **18**, e.g. approximately 4 inches in length. Thus, the stresses or strains in the blade mount member **16** are significantly decreased versus, for example, those mounting assemblies that include members that shift by an amount generally corresponding to the displacement of their blades.

Further, the stiffness and resiliency of the preferred angle spring plate construction of the blade mount member **16** allows the resilient shifting of the blade **14** to be highly controlled so that it only deflects by an amount needed to minimize loading thereon, as has been mentioned. In this regard, the radius of curvature of the arcuate portion **20** is larger than the thickness of the layback arm **18** and arcuate portion **20**, which when formed as a unitary angled spring plate member with the base portion **22** are of constant thickness. The large size of the radius of curvature of the arcuate portion **20** relative to the thickness of the blade mount member **16**, and particularly the arm and arcuate portions **18** and **20** thereof provides the blade mount member **16** configured in its relaxed state with its preferred 60 degree layback angle **24** a stiffness that is tailored to provide the blade **14** with substantially constant blade-to-belt contact for optimized cleaning efficiencies. For each degree that the relaxed layback angle is decreased, the spring loading on the blade **14** is increased by approximately eight pounds, on average. At the same time, the layback angle **24** along with the relatively long length of the layback arm **18** allows the blade **14** to deflect sufficiently when excessive loading is applied thereto via relatively small deflections of the arcuate portion **20** to minimize blade wear, as previously discussed.

By way of example and not limitation, with respect to the preferred unitary, angled spring plate construction of the blade mount member **16**, the thickness of the spring plate member **16** can be approximately 0.062 inch and the radius of the lower arcuate portion **20** can be approximately 0.25 inch. The vertical height of the member **16** measured from the bottom of the base **22** to the top of the layback arm **18** is approximately 4.0 inches with the base **22** having a length measured from its transition with the arcuate portion **20** to the downstream free end thereof of approximately 2.0 inches. With the above dimensions, the total length of the spring plate member **16** as measured along the surface from the free end **19** of the arm **18** about the arcuate portion **20** and to the free end of base **22** is approximately 6.62 inches. With these dimensions, approximately 7 degrees in reduction in the angle **24** generates approximately 0.25 inch of vertically downward displacement of the blade **14**. And a five degree reduction such as can occur with tensioning of the blade **14** into the belt **12** as described hereinafter will generate an approximately forty pound bias force on the blade **14** via the deflected layback arm **18**.

To minimize blade chatter, a resilient dampening material **28** can be attached between the blade mount member **16** and a rigid support assembly **30** therefor. In the preferred form, the resilient material **28** is fixed between the base **22** of the angled spring plate blade mount **16** and the rigid support **30** thereunder to provide the mount member **16** with a resilient base assembly **31**. In this regard, the resilient material **28** is selected according to the application in which the cleaning assembly **10** herein is to be employed. In lower temperature applications, the material can be a commercial grade of neoprene rubber, whereas for higher temperature applications for which the metal spring plate mount member **16** is especially well-suited, the material **28** can be in the form of a silicone pad secured between the mount member **16** and support assembly **30** which is resistant to degradation up to temperatures of approximately 450 degrees Fahrenheit.

The resilient pad **28** allows the present cleaning assembly **10** to be better employed as a primary cleaner at the discharge head pulley of a conveyor belt system. Because the blade **14** of the primary cleaner is engaged against the belt **12** as it travels around the head pulley, there is less give with the blade **14** tensioned into the belt **12** and blade chatter can be more problematic. As such, the cleaning assembly **10** herein is best employed as a primary cleaner when the resilient pad **28** is utilized under the blade mount member **16** so as to better maintain conformance of the blade **14** against the conveyor belt **12** with a minimum of chatter. By contrast, where the cleaning assembly **10** is used as a secondary cleaner along the return run of the conveyor belt **12** downstream from the head pulley, the use of the resilient pad **28** is more optional.

The cleaning assembly **10** herein preferably includes several blade mount members **16** each including a scraper blade **14** secured thereto so as to extend for substantially the full width of the conveyor belt **12** traveling thereover. In this manner, the full extent of the width of the belt **12** is scraped clean by the blades **14** while allowing for more localized deflections of the blades **14** as they encounter irregularities that do not necessarily extend across the full width of the belt **12**. Accordingly, while one of the blades **14** may be deflected downwardly due to an impact therewith, the other blades **14** can remain in tight engagement with the belt surface **12***a*.

Referring next to FIGS. **2–6**, to secure the plurality of the blade mount members **16** under the conveyor belt **12**, the support assembly **30** can be a known pole assembly having a pole member **32** extending underneath the belt transverse to the downstream running direction **34** thereof, and an elongate right-angle bracket **36** which has its legs **38** and **40** secured as by welding to the top and front side of the pole **32**, respectively. The blade mount members **16** are secured to the upper leg **38** as by bolting of either the base portion **22** thereto or the resilient base assembly **31** thereto (FIGS. **7** and 7A–7C).

The width blade mount members **16** can be approximately 5.75 inches so that preferably two bolts **42** are used to secure them to the pole assemblies **30**. The bolts **42** are disposed generally intermediate the free end of the base **22** and the upstream end of the arcuate portion **20**. The bolts **42** can provide for a pivot location for the blade mount member **16**, as shown in FIG. 7C. To this end, when excessive loads are encountered by the blade **14**, not only does the layback arm **18** deflect rearwardly and downwardly, but the forward portion **44** of the base **22** can lift or pivot up in a direction away from the resilient pad member **28** or toward the belt **12** while the rear portion **45** pivots downwardly compressing the pad **28** thereunder, as shown. The resilient nature of the material of the pad **28** can accommodate this pivoting by bulging slightly at the rear end portion **28***a* of the pad slightly out beyond the free end of the base **22**, with the front end portion **28***b* of the pad **28** expanding to take up the space provided by the pivoting up of the base forward portion **44** so as to stay engaged therewith. Accordingly, by allowing the base **22** to rock or pivot about the bolts **42**, the present blade mount member **16** is provided with an additional deflection allowance to keep the blade **14** in substantial conformance with the belt **12** despite surface irregularities along the belt surface **12***a* that it may encounter. With the forward portion **44** of the base **22** pivoted up toward the belt in a direction away from the resilient pad **28**, the layback arm **18** is able to lean further back rearwardly for providing the blade **14** with a greater amount of deflection.

Continuing reference to FIGS. **2–6**, the pole assembly **30** is supported at either end via side frame members **46** of the frame for the conveyor belt **12**. The pole assembly **30** is adjustably supported at the opposite end portions by a rotational screw damp adjustment mechanism **47** including split bearing blocks **48** that are themselves adjustable along slotted vertical plate portions **50** of the frame members **46**, as will be described more fully hereinafter.

More particularly, the bearing blocks **48** include a pair of arc shaped members **52** and **54** that cooperate to define a cylindrical opening **56** through which the opposite ends of the pole **32** can extend. The split block members **52** and **54** are spaced by an adjustable gap **58** which can be reduced in size by appropriate tightening or loosening rotation of adjustment screws **60** extending through the block member **52** and threaded into tapped apertures (not shown) in block member **54**. Accordingly, to rotationally adjust the pole **32** in the bearing blocks **52**, the adjustment screws **60** are loosened to widen or increase the size of the gap **58** between the block members **52** and **54**. The pole **32** can then be rotated in the openings **56**. This allows the angle of the attack of the blade **14** relative to the belt surface **12***a* to be adjusted. In this regard, if the angle of attack is to be other than 60 degrees, i.e. corresponding to the layback angle **24**, the pole **32** is rotated so that the upper bracket leg **38** is no longer perfectly horizontally oriented, along with the base **22** or base assembly **31** attached thereto. Once the desired angle of attack is achieved, the adjustment screws **60** are tightened so that the semi-circular arcuate surfaces **52***a* and **54***a* on the respective block members **52** and **54** are brought into tight clamping engagement with the cylindrical surface of the pole **32** rotationally fixing the pole assembly **30** in place.

With the angle of attack fixed as described above, the tension of the scraper blade **14** in engagement with the belt **12** can next be set by vertical adjustment of the cleaning assembly **10**. For this purpose, a vertical screw adjustment mechanism **62** is provided. The vertical adjustment mechanism **62** includes a bracket member **64** that is fixed to the vertical plate portion **50** below the bearing blocks **48**. An adjustment screw **66** extends through an opening in horizontal leg **68** of the bracket **64** and is threaded through nuts **70** engaged on either side of the leg **68** so that the distal upper end **72** abuts against the bottom surface of the bearing block **48**, and specifically the block member **54** thereof. The block member **54** is slidingly secured to the frame plate **50** via fasteners including shanks extending from the block **54** through a vertical guide slots **74** of the frame plate portion **50**. Enlarged fastener heads **76** on the shanks are disposed on the other side of the plate portion **50** from the block member **54** to keep it slidingly secure thereto.

Accordingly, to adjust the tension of the blade **14**, the adjustment screw **66** is turned in the tightening direction causing it to advance through the bracket leg **68** with the abutment end **72** pushing the bearing block **48** upwardly, along with the support assembly **30**, and the blade mounts **16** and associated blades **14** therewith. If the tension is excessive, the adjustment screws **66** are turned in the loosening direction to retract the screw **66** and abutment end **72** thereof, lowering the bearing block **48** accordingly. Generally, the angle **24** will be reduced by a small amount, e.g., 5°, such as from the preferred 60° to 55°, with the blade **14** appropriately tensioned into engagement with the belt **12** due to slight bending or pivoting of the arm **18** toward the base **22**. As mentioned, with the preferred and illustrated blade mount member **16** including an angle **24** of 60° between the arm **18** and base **22**, such a 5° reduction will generate a bias force of approximately forty pounds on the blade **14** engaged with the belt **12**, based on the spring force of approximately eight pounds per degree of layback angle reduction from the relaxed state provided by the blade mount member **16**.

An alternative blade mount member **78** is depicted in FIG. **12**. The blade mount member **78** is substantially the same as the blade mount member **16** except that the upper end of the layback portion **80** includes an upturned end or end portion **82** that extends substantially vertically or normal to the belt surface **12***a* so that the scraper blade **14** secured thereto has a more aggressive angle of attack relative to the belt **12** versus the layback angle provided by blade mount member **16**.

Even with the more aggressive cleaning angle provided by blade mount **78**, its configuration including the layback portion **80** and lower arcuate portion **84** provides many of the same advantages as the mount member **16**. More particularly, the layback portion **80** extends toward the belt surface **12***a* at a preferred layback angle of approximately 60 degrees that it forms with the generally horizontally oriented base portion **86** thereof, interconnected to the layback portion **80** via the arcuate portion **84**. The layback arm portion **80** allows the blade **14** to simultaneously shift both vertically and horizontally when loaded. The layback portion **80** is sized and the arcuate portion **84** is radiused such that relatively small angular changes between the layback portion **80** and the base portion **86** result in relatively large vertical displacements of the blade **14** without requiring excessive horizontal displacement thereof. Similarly, this vertical displacement of the blade **14** is achieved with relatively small incremental decreases in the radius of curvature of the arcuate portion **84** resulting in a lower strain on the blade mount member **78**, as discussed with respect to blade mount member **16**.

The preferred scraper blade **14** used with the blade mount members **16** and **78** herein will next be described. Referring to FIGS. **10** and **11**, the scraper blade **14** has a generally rectangular body **84** such as of metal material. The blade body **84** has a pair of through apertures **86** disposed in the lower region thereof to allow for bolting to the blade mount members **16** and **78**. As can be seen in FIG. **10**, the blades **14** extend for substantially the full width of the blade mount members **16** and **78**, and particularly the respective layback portion **18** and upturned portion **82** thereof. At the upper end region of the blade body **84**, a tip **88** of hard material such as carbide is embedded thereat such that there are thinned portions **90** and **92** on either side of the hardened tip **88** with the flat tops of the tip **88** and the thinned portions **90** and **92** generally flush with each other, as best seen in FIG. **11**. This hardened tip **88** of the blade body **84** provides the blade **14** with greater impact resistance to more readily allow the cleaner assembly **10** herein to be utilized with those conveyor belts **12** having mechanical and vulcanized splices therein.

While there have been illustrated and described particular embodiments of the present invention, it will be appreciated that numerous changes and modifications will occur to those skilled in the art, and it is intended in the appended claims to cover all those changes and modifications which fall within the true spirit and scope of the present invention.

What is claimed is:

1. A cleaner for conveyor belts comprising:

a scraper blade for engaging against a conveyor belt running in a downstream travel direction;

a blade mount member that resiliently keeps the blade engaged against the belt;

a layback portion of the mount member having an upper end including a flat surface to which the scraper blade is secured and extending at a predetermined layback angle toward the belt for a predetermined distance; and

a lower arcuate portion of the mount member spaced upstream of the upper end of the layback portion with the lower arcuate portion flexing during conveyor belt operations and having a predetermined radius of curvature that is minimized relative to the distance the layback portion extends so that the layback portion has a relatively long length for providing controlled deflections of the layback portion as a result of high impact forces against the scraper blade that reduces loading on the scraper blade and substantially keeps the scraper blade engaged against the belt as the belt is running,

wherein the scraper blade includes a tip of hard material for engaging the belt.

2. The conveyor belt cleaner of claim **1** herein the predetermined layback angle of the layback portion is sized to minimize material build-up on the flat upper surface of the layback portion during conveyor belt operations.

3. A cleaner for conveyor belts comprising:

a scraper blade for engaging against a conveyor belt running in a downstream travel direction;

a blade mount member that resiliently keeps the blade engaged against the belt;

a layback portion of the mount member having an upper end to which the scraper blade is secured and extending at a predetermined layback angle toward the belt; and

a lower arcuate portion of the mount members paced upstream of the upper end of the layback portion with the lower arcuate portion flexing during conveyor belt operations for controlled deflections of the layback portion that reduces loading on the scraper blade and substantially keeps the scraper blade engaged against the belt as the belt is running, wherein the blade mount member includes a resilient base assembly connected to the arcuate portion for cushioning the member against impacts on the blade and minimizing chattering thereof.

4. The conveyor belt cleaner of claim **3** wherein the resilient base assembly comprises a flat base portion integrally connected to the arcuate portion and extending rearwardly therefrom generally in the belt travel direction, and

a layer of resilient material secured beneath the flat base portion for damping vibrations of the blade during conveyor belt operations.

5. The conveyor belt cleaner of claim **3** wherein the blade mount member is of a unitary construction.

6. The conveyor belt cleaner of claim **5** wherein the blade mount member is of metal material for use in high temperature environments, the metal layback portion has a flat configuration, and

a metal base portion extending rearwardly from the metal arcuate portion generally in the belt travel direction with the layback angle formed between the layback portion and the base portion such that the layback portion pivots toward and away from the base portion with flexing of the arcuate portion during conveyor belt operations.

7. The conveyor belt cleaner of claim **1** wherein a plurality of the blade mount members and scraper blades are provided for extending across the conveyor across the conveyor belt to be cleaned.

8. A cleaner for conveyor belts comprising:

a scraper blade for engaging against a conveyor belt running in a downstream travel direction;

a blade mount member that resiliently keeps the blade engaged against the belt;

a layback portion of the mount member having an upper end to which the scraper blade is secured and extending at a predetermined layback angle toward the belt; and

a lower arcuate portion of the mount member spaced upstream of the upper end of the layback portion with the lower arcuate portion flexing during conveyor belt operations for controlled deflections of the layback portion that reduces loading on the scraper blade and substantially keeps the scraper blade engaged against the belt as the belt is running, wherein the layback portion includes an upturned end portion at the upper end thereof to which the scraper blade is secured with the upturned end portion extending substantially normal to the conveyor belt for providing the scraper blade with an optimized angle of contact with the belt.

9. A conveyor belt cleaning assembly for high temperature conveyor belt operations, the conveyor belt cleaning assembly comprising:

a frame;

a scraper blade including a tin of hard material for engaging a conveyor belt;

a rigid support of the frame; and

a resilient blade mount of a shape-retentive metal material between the blade and the support to space the blade from the support, the blade mount secured to the support and having a unitary, angled spring plate construction forming a layback angle relative to the belt for resiliently biasing the scraper blade into engagement with the conveyor belt running in high temperature environments and so that the scraper blade resiliently shifts both horizontally and vertically upon impacts therewith.

10. The conveyor belt cleaning assembly of claim **9** wherein the metal blade mount includes a layback portion extending toward a surface of the conveyor belt with which the blade is engaged and a base portion generally extending at the predetermined layback angle to the layback portion that minimizes material build up on the layback portion and allows the blade to pivot back and away from the belt and down toward the base portion during conveyor belt operations.

11. A conveyor belt cleaning assembly for high temperature conveyor belt operations, the conveyor belt cleaning assembly comprising:

a frame;

a scraper blade for engaging a conveyor belt;

a rigid support of the frame; and

a resilient blade mount of a shape-retentive metal material secured to the support and being configured for resiliently biasing the scraper blade into engagement with the conveyor belt running in high temperature environments, wherein the metal blade mount includes a layback portion extending toward a surface of the conveyor belt with which the blade is engaged and a base portion extending at a predetermined layback angle to the layback portion that minimizes material build up on the layback portion and allows the blade to pivot back and away from the belt and down toward the base portion during conveyor belt operations, and the metal blade mount includes an upper portion extending vertically upward from the layback portion substantially normal to the belt.

12. A conveyor belt cleaning assembly for high temperature conveyor belt operations, the conveyor belt cleaning assembly comprising:

a frame;

a scraper blade for engaging a conveyor belt;

a rigid support of the frame; and

a resilient blade mount of a shape-retentive metal material secured to the support and being configured for resiliently biasing the scraper blade into engagement with the conveyor belt running in high temperature environments, and

a resilient material fixed between the metal blade mount and the support for cushioning and minimizing chattering of the blade during conveyor belt operations.

13. The conveyor belt cleaning assembly of claim **12** wherein the resilient material is operable at temperatures up to approximately 450 degrees Fahrenheit.

14. The conveyor belt cleaning assembly of claim **9** wherein the blade mount includes a resilient pivot portion and a layback portion extending upwardly and rearwardly from the pivot portion toward the belt generally along a direction of travel thereof, and the blade is fixed to the layback portion to extend in the same direction as the layback portion and into engagement with the belt.

15. The conveyor belt cleaning assembly of claim **9** wherein the rigid support includes adjustment mechanisms that allow rotary and linear shifting of the blade mount for changing an angle of attack of the blade relative to the belt and engagement force of the blade with the belt.

16. A cleaning blade assembly comprising:

a cleaning blade including a tip of hard material for engaging a conveyor belt;

an upper layback portion extending toward a conveyor belt for having the cleaning blade secured thereto;

a lower base portion extending transverse to the upper layback portion for securing the mount to a support therefor; and

an intermediate arcuate portion that extends for less than 90° for interconnecting the layback and base portions and having a variable radius of curvature to allow shifting of the layback portion relative to the base portion during conveyor belt operations.

17. The cleaning blade assembly of claim **16** wherein the layback portion is maximized in length, and the layback portion and base portion define a predetermined acute angle therebetween selected for maximum vertical displacement of the blade with a minimum of horizontal displacement and minimizing accumulation of material scraped off the belt on the layback portion.

18. The cleaning blade assembly of claim **16** wherein the layback, base and arcuate portions are of a unitary construction.

19. A cleaning blade mount comprising:

an upper layback portion extending toward a conveyor belt and having a cleaning blade secured thereto;

a lower base portion for securing the mount to a support therefor; and

an intermediate arcuate portion interconnecting the layback and base portions and having a variable radius of curvature to allow shifting of the layback portion relative to the base portion during conveyor belt operations, wherein the conveyor belt travels about a head pulley, the layback, arcuate and base portions are of an angled metal plate construction,

resilient material between the base portion and support for cushioning the blade extending into engagement with the belt traveling about the head pulley.

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UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 6,823,983 B2
DATED : November 30, 2004
INVENTOR(S) : Brett E. DeVries

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 11,
Line 41, delete “members paced” and insert -- member spaced --.
Line 59, delete “claim 3” and insert -- claim 1 --.

Column 12,
Line 7, before “belt” delete “across the conveyor”.
Line 34, delete “tin” and insert -- tip --.

Signed and Sealed this

Thirtieth Day of August, 2005

JON W. DUDAS
Director of the United States Patent and Trademark Office